TASKFORCE RECOMMENDATIONS FOR THE MPRAC

DIGITAL MEDIA ENTERPRISE SOFTWARE (DMES) SECTOR

INTRODUCTION

As a sector, *Digital Media and Enterprise Software (DMES*) industry continues to drive Louisiana's transition and transformation into an economic powerhouse. State leaders in higher education and economic development recognize innovation as a significant step toward strengthening and diversifying Louisiana's increasingly knowledge-based economy. The 2014 State New Economy Index (SNEI) highlighted Louisiana as the fifth most-improved state since 2010 for the share of private sector employed as scientists or engineers.

Last year, in a study comparing metropolitan regions throughout the United States, the Ewing Marion Kauffman Foundation cited Baton Rouge as having the second-highest increase in high-tech startup density among mid-to-large metro areas from 1990 to 2010. New Orleans continues to serve as the destination for high-tech startups, leading to economic renaissance of the region. In 2013, Area Development magazine crunched federal and private data for 21 indicators to determine where 380 U.S. metros rank for economic and job growth. Silicon Valley – the metro San Jose, California area was ranked No. 2. No.1? Lafayette, Louisiana. Shreveport-Bossier has established itself as a major cybersecurity center in the US. As a catalyst for growth, Louisiana's creation of powerful partnerships between universities and private employers continues to deliver.

The trend is particularly visible in Louisiana's fast-growing technology sector, where recently announced projects will create more than 3,000 new software development and information technology direct jobs over the next four years. Firms that choose Louisiana for technology projects describe the state as a pioneer in the use of training partnerships. And those firms — Perficient, Enquero, CGI, CSC, GE Capital, IBM and others — repeatedly point to the opportunity to collaborate with higher education partners on research innovations and workforce as a critical component of their site-selection decisions.

University-industry partnerships empower Louisiana's research universities to produce research driven innovations in collaboration with industry, make meaningful changes to the training and education of their students, ensuring that graduates are optimally prepared for the workforce. For software and IT firms, the benefit is a bigger pipeline of employees possessing the precise skills they demand.

Of the more than dozen topical areas that the Taskforce considered, three specific areas are being recommended for investment, based on existing strengths and aspirational goals of Louisiana universities. The MPRAC recommendations provided in this report seek to build on this exceptional nascent platform to build capacity to sustain the development of partnerships with these IT companies and generate greater research and workforce development opportunities in Louisiana.

HIGH IMPACT OPPORTUNITIES FOR INVESTMENT

AREA 1: BIG DATA AND ANALYTICS

1.A. Research Initiatives

Scientists, engineers, educators, citizens and decision-makers have unprecedented amounts and types of data available to them. Data come from many disparate sources; can be temporal, spatial, or dynamic; structured or unstructured; information and knowledge derived from data can differ in representation, complexity, granularity, context, provenance, reliability, trustworthiness, and scope. Data can also differ in the rate at which they are generated and accessed. The phrase "big data" refers to data that challenge existing methods due to size, complexity, or rate of availability.

In a report published in June 2011, McKinsey Global Institute (MGI) presented their analysis of big data in five domains—healthcare in the United States, the public sector in Europe, retail in the United States, and manufacturing and personal-location data globally. The report asserts that a retailer using big data to the fullest extent could increase its operating margin by more than 60 percent. If US healthcare were to use big data creatively and effectively to drive efficiency and quality, the sector could create more than $300 billion in value every year. In the developed economies of Europe, government administrators could save more than €100 billion ($149 billion) in operational efficiency improvements alone by using big data. And users of services enabled by personal-location data could capture $600 billion in consumer surplus.

The challenges in managing and analyzing "big data" can require fundamentally new techniques and technologies in order to handle the complexity, size, or rate of availability of these data. Ensuring appropriate privacy and security guarantees may become increasingly challenging as well. At the same time, the advent of big data offers unprecedented opportunities for data-driven discovery and decision-making in virtually every area of human endeavor. A key example of this is the scientific discovery process, which is a cycle involving data analysis, hypothesis generation, the design and execution of new experiments, hypothesis testing, and theory refinement. Realizing the transformative potential of big data requires addressing many challenges in the management of data and knowledge, computational methods for data analysis, and automating many aspects of data-enabled discovery processes. Combinations of computational, mathematical, and statistical techniques, methodologies and theories are needed to enable these advances. Other challenges include the development of technical infrastructure to support big data and to ensure that appropriate safeguards are in place to address public concerns about big data. Three primary areas of research include:

- Big data and knowledge management;
- Techniques for analyzing big data including research in predictive modeling, statistical tools and algorithms; and
- Big data technologies and visualization approaches.

In March 2012, the White House announced the "Big Data Research and Development Initiative," with six federal agencies announcing more than **$200M** in new funding opportunities in the area. Louisiana researchers are well positioned to attract these funds, as evidenced below.

1.B. Existing and Prospective Strengths

- Designation of UL Lafayette by the National Science Foundation as the nation's only NSF Industry-University Cooperative Research Center (IUCRC) in the area of big data through the *NSF Center for Visual and Decision Informatics* (CVDI). Industry members include CGI, Johnson & Johnson, Lockheed Martin, Microsoft Research, Louisiana Immersive Technologies Enterprise, Louisiana Department of Health and Hospitals, Louisiana Health Care Quality Forum, among others. With the recent addition of academic and industry partners from Finland (Tampere University of Technology and DIGILE,) the CVDI became one of only 6 such NSF Centers in the US to have an international site. DIGILE – Finland's Strategic Centers for Science, Technology and Innovation (SHOKs) chose to work with the NSF CVDI after considering the 66 NSF I/UCRC centers across the US, given the center's strong research focus in the emerging area of big data, past projects, and strong leadership. Recent NSF funding successes include:
    - $499,998 - Raju Gottumukkala, Center for Visual and Decision Informatics, A distributed visual analytics sandbox for high volume data streams.
    - $491,513 - Ben Blundell, Information Technology, Cyber-infrastructure - Creation of science DMZ at UL.
    - $460,000 - Nian-Feng Tzeng, Center for Advanced Computer Studies, Cooperative memory expansion for networked computing systems via remote direct memory access.
    - $297,767 - Christoph Borst, Center for Visual and Decision Informatics and the Center for Advanced Computer Studies, Collaborative big data exploration in networked VR environments.
    - $220,348 - Raju Gottumukkala, Center for Visual and Decision Informatics, A virtual crisis information sharing and situational awareness platform for collaborative disaster response.
- LSU Center for Computation and Technology (CCT) and LSU College of Engineering have recently enhanced their scientific computation and research faculty expertise in the area of big data.
    - $947,860 - LSU's Seung-Jong Park, associate professor of computer science with joint appointment in the CCT, for a campus-wide project aimed at bringing "Big Data" computational capabilities to University research groups. Samsung Electronics is also participating in the project as an industrial collaborator. The project, titled "CC-NIE Integration: Bridging, Transferring and Analyzing Big Data over 10Gbps Campus-Wide Software Defined Networks," will empower scientific breakthroughs at LSU by providing researchers with advanced information technologies and cyber-infrastructure.

- Tulane University has recently invested into a HPC cluster to advance its efforts in this area. Named *Cypress*, this supercomputer will be ranked in the Top 500 fastest computers the world. When complete, Cypress will deliver a peak general capability of 370 teraflops and will incorporate 7.936 terabytes of fast main memory with 1 petabyte of high-performance storage. This system allows users to move seamlessly between big data analytics and traditional HPC capabilities.
- Louisiana Tech recently established the Louisiana Cyber and Data Consortium (LACDC) - a collaborative endeavor of Louisiana Tech University and the Cyber Innovation Center in Bossier City. The LACDC represents a broad range of constituencies from academia, industry, and government with interests in the security and protection of Louisiana's assets from cyber and related threats, in the storage and management of large data sets, and in the use of large data sets for analytical and business decisions.
    - $525,000 – Louisiana Tech's Sumeet Dua is providing data mining and analytical support to the bioinformatics and Biocomputing core of NIH-funded Louisiana Biomedical research Network. The initiative involves design and development of unsupervised and supervised learning approaches for big data applications in a variety of biomedical domains.

Recommendations:

- **Short-term:** BOR consider investing funds into hosting a statewide workshop on big data including researchers, industry leaders and federal government sponsors. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, Industry leaders, Louisiana Economic Development, Federal Agencies.

- **Medium-term**: BOR consider investing 1:1 matching funds into existing NSF and other such national-scale centers and provide seed funds to help pursue the development of new national Centers such as other NSF IUCRCs, STCs, ERCs, NIH BD2Ks, etc. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, Federal Agencies.

- **Long-term**: BOR consider leveraging its prior investments into LONI and the LONI Institute to make significant infrastructure investments into federated big data compute capacity in Louisiana. This includes investments into big data computational clusters connected to high-performance storage and memory that leverage connectivity through LONI. Further, the BOR should consider re-investments into a statewide research capacity program (such as the successful LONI Institute) into funding scientific and technical personnel to exploit such big data infrastructure investments. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, LONI Management Council.

2.A. Tech Transfer and Commercialization

Collaborations exist with Louisiana-based industry partners such as IBM, CGI, CSC, GE Capital, Fenway Group, and Enquero (a startup company), among others.

These companies are all focused on growing their respective business offerings in the area of big data products and services. CVDI Advisory Board members such as Johnson & Johnson, Lockheed Martin, Microsoft Research, are interested in big data innovations from universities. Strong partnerships that Louisiana universities have with these companies (mostly unavailable previously), provide significant opportunities for commercialization of technologies developed at universities in Louisiana.

Recommendations:

- **Short term**: Provide state funds for expansion of NSF CVDI and the IUCRC model to other Louisiana universities and other Louisiana-based IT companies. A BOR funded managing director position and/or scientific staff would help the expansion of CVDI to work with the new IT companies in the State. *Key Participants*: BOR Office of Sponsored Programs, NSF CVDI, VPs/VCs of Research, Faculty, Industry.

- **Medium-term:** Fund translational research opportunities in the area of big data; especially with enhanced funding allocation to the BOR ITRS program. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, Industry.

- **Medium-term:** Establish a statewide proof-of-concept funding that is vital to transferring the research out of the labs and into the marketplace. *Key Participants*: Louisiana Economic Development, Louisiana Innovation Council, BOR Office of Sponsored Programs, VPs/VCs of Research, Louisiana Venture/Angel fund operators such as Louisiana Fund One/Two, etc.

- **Long-term:** The IUCRC's shared model of intellectual property has been successful in enhancing technology licensing and commercialization opportunities at UL Lafayette through NSF CVDI. In the past 2 years, over 16 technologies have been licensed to industry and other organizations affiliated with the center. BOR should consider facilitating existing and new industry-university collaborations and help the expansion of IUCRC models across Louisiana. In this context, Louisiana should leverage its status as an EPSCoR State and pursue opportunities with the National Science Foundation, and other agencies. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, Federal Agencies.

3.A. Workforce Development

Companies and other organizations need to address considerable challenges if they are to capture the potential of big data. The US alone faces a shortage of 140,000 to 190,000 people with deep analytical skills as well as 1.5 million managers and analysts to exploit big data for decision making. Specific investment opportunities include the following:

- **Short-term**: BOR consider support for the creation of undergraduate and graduate courses and degree programs for traditional students in the area of

big data. Special consideration should be given to customized, interdisciplinary degrees focused on big data. Other target student groups should include Veterans and first-generation college students. BOR should specifically support linkages between research universities, community and technical colleges, and K-12 schools for workforce development in this critical area. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Louisiana Workforce Commission, Louisiana Economic Development, Louisiana Department of Education, Louisiana Community and Technical College System (LCTCS).

- **Medium-term:** BOR should consider supporting the development of flexible-duration certification programs for industry professionals and non-traditional students. These courses should be available both in traditional and on-line distance learning delivery models. Further, BOR should dedicate matching funds (1:1 match) to support industry apprenticeship and internship opportunities. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Louisiana Economic Development FastStart.

- **Long-term:** Consider development of statewide partnerships with Big Data companies (like SAP, Splunk) and acquire statewide technology licenses for tools such as SAP HANA, Tableau, Splunk Enterprise, etc.) for research, instruction and training. *Key Participants*: BOR Office of Sponsored Programs, Division of Administration Office of Information Technology, VPs/VCs of Research.

AREA #1: ALIGNMENT WITH EVALUATION CRITERIA

1. *Maintain and build strength in targeted foundational science and technology disciplines identified in FIRST Louisiana:* The research area of Big Data fits within the foundational sciences area of "Computer Sciences"; producing innovations and 21st Century Building Blocks that are manifest in "Bits and Bytes". Core Enabling S&T Research advances in Computational Science and Information Technology will result in translational research in Digital domains. Given the unique, cross-cutting nature of big data applications, we expect this research area to result in innovations in multiple Core Industry S&T sectors as well as High Growth Target Industries identified by LED. Big data research is expected to impact industries ranging from materials and chemical manufacturing, energy production, to coastal and water management, biomedical and healthcare innovations, to the applications in digital media, cyber- and cyber-physical systems.
2. *Promote targeted multidisciplinary and multi-institutional collaborative research efforts:* Big data research is inherently multi-disciplinary, sitting at the intersection of Computer Science, Social Sciences (law, policy) and Mathematics (algorithms, analytics) as foundational scientific building blocks. As noted previously, research universities in Louisiana have each invested substantially in this area – in research, economic development and workforce development – and are well positioned to leverage prior statewide

collaborations on such initiatives as LONI to enhance Louisiana's national standing in this high-priority area.

3. *Demonstrates prospective alignment and competitiveness with national priorities, needs, and funding:* As previously noted, Big Data is a big national priority, with over $200M in federal funding. The White House has designated Big Data as a strategic national imperative.
4. *Sustain and advance targeted research commercialization and translational activities that promote economic development in Louisiana:* With the advent of high-technology companies such as IBM, GE Capital, CGI, CSC, etc., there are great opportunities to advance targeted research commercialization efforts. Furthermore, with a successful track record of IUCRCs in this area, there is a great foundational platform upon which we can build translational research programs in this area.

AREA 2: CYBERSECURITY, INFORMATION ASSURANCE AND INTERNET OF THINGS

1.A. Research Initiatives

Cybersecurity, information assurance, and privacy have emerged as major concerns as issues that impact our human rights, commercial enterprises, and national security affecting our nation's critical infrastructures. Modern cyber-physical systems incorporate components from different providers using explicit interface standards that specify communication protocols, physical operation characteristics, real-time sensing and human operators informed by real-time data from the cyber-physical sensors. The trend towards distribution has recently accelerated as these systems have been employing the "Internet of Things" as a backbone. The White House report entitled "*Big Data: Seizing Opportunities, Preserving Values*" states that "*…we are only in the very nascent stage of the so-called Internet of Things, when our appliances, our vehicles and a growing set of "wearable" technologies will be able to communicate with each other…since 2005, business investment in hardware, software, talent, and services has increased as much as 50 percent, to $4 trillion."*

Entire system analysis is critical for security: integrity and conformance to expected behavior of computing devices controlling physical systems; assurance of software components; integrity and reliability of communications; effective, secure control in centralized systems like cloud services managing cyber-physical infrastructure; and appropriate social infrastructure to ensure adoption and use.

The US Cybersecurity market is expected to grow by more than 6% a year, according to Market Research Media Ltd., with the potential to reach $65.5 Billion by 2018. Federal Agencies across the Networking and Information Technology Research and Development (NITRD) program each spend over $70 million each year on privacy research. This research in this area falls into broad categories of: support for privacy as an extension of security; research on how enterprises comply with privacy laws; privacy in health care; information assurance, malware detection, and basic research into technologies that enable privacy.

Despite defense budget cuts the U.S. government is still expanding its cyber warfare capabilities, a fact not lost either on America's adversaries or allies in undeclared but raging cyberwar. Cyber war fare is becoming the weapon of choice in what could be termed as The Great Game of the 21st century. With a cumulative market valued at $65.5 billion (2015 – 2020), the U.S. Federal Cybersecurity market will grow steadily at about 6.2% CAGR**.** Louisiana's universities are well positioned to attract these funds to advance the state's position as an emerging cyber-engineering and innovation center in the US.

1.B. Existing and Prospective Strengths

- Cyber Innovation Center (CIC): $107M investment into Cyber Research Park in Northwest Louisiana leading to the 135,000 sq.ft. Cyber Innovation Center. CIC houses the National Integrated Cyber Education Research Center, as well as such companies as Boeing, Northrop Grumman, Lockheed Martin, and most recently CSC.

- Most recently, several universities in Louisiana collaborated under the leadership of LSU, on the development of a proposal to be designated as a DHS Critical Infrastructure Resiliency Center (CIRC), with a major focus on cyber security and mitigating cyber-impacts to critical infrastructures. If funded, this partnership will be the 10th DHS Center of Excellence in the US - expanding Louisiana's credentials in the domains of cybersecurity and homeland security.
- **Louisiana Tech University** pursues cutting-edge research in the disciplines of Computer Science, Computer Information Systems, Communication Systems, Cyber Engineering, Geographic Information Systems, and Health Informatics. The research agenda includes topics in cybersecurity, cybernetics, data mining, sensor fusion, information assurance, biomedical informatics, data analytics and communications design.
    - *Center for Secure Cyberspace:* The Center for Secure Cyberspace (CSC) is a joint collaboration between Louisiana Tech University and Louisiana State University, initially funded through the State's PKSFI program, but sustained through multiple funding sources was created to assist faculty members in their research, and to support federal, state, and private sector cyberspace security needs in collaboration with the Cyber Innovation Center (CIC) in Bossier City, Louisiana. The Core Research Team and their students have collaboratively worked on rare and event pattern detection, malware and botnets, anomaly detection, cyber forensics, information fusion, secure information dissemination, grid computation, interactive visualization, adversarial cyber-behavioral biometrics, unmanned aerial vehicles and sensor networks.

    - *National Center of Academic Excellence in Information Assurance Research and Education*: The National Security Agency (NSA) and Department of Homeland Security (DHS) designated Louisiana Tech University as a National Center of Academic Excellence in Information Assurance Research for academic years 2012 through 2017. The designation is the nation's premier academic certification for cybersecurity research. Louisiana Tech was previously designated as a National Center of Academic Excellence in Information Assurance Education. Louisiana Tech is one of only 35 comprehensive research universities in the nation and the only university in the State of Louisiana to attain both designations.

- **UNO's** Greater New Orleans Center for Information Assurance (GNOCIA) is a nationally recognized center in information assurance and cybersecurity which aligns with the Cybersecurity High Growth Target Industry, the Info Tech & Services Core Industry S&T Sector, the Digital Translational Research Domain and the Computer Science and Information Technology Core Enabling S&T Research areas. The center involves nationally-recognized faculty from the Department of Computer Science.
    - GNOCIA researchers have been PIs on numerous federal awards in support of the SPAWAR Systems Command Atlantic (SSC-LANT). UNO has supported the SSC-LANT facility through several contracts over the past several years and currently has two open contract vehicles. One

contract is for $50m over 5 years (UNO is currently in the third year) with UNO as the prime, and provides a mechanism for local IT businesses to aid in that effort. The second contract is for $30M over 6 years and is a multiple award contract between UNO and six other universities and SSC-LANT in Charleston, SC. Total amount of all contracts: $14,262,500.00; Number of UNO employees on SPAWAR contracts: 133; Number of businesses supported: 5; Total amount of subcontracted to businesses: $8,931,013.00; Number of UNO students who have completed internships with either SSC-LANT or these businesses: 11

- UNO has the strongest Information Assurance (IA) program in the region and is designated as a National Center of Academic Excellence (CAE) in Information Assurance Education (CAE) and Research (CAE-R) by the National Security Agency (NSA) and the Department of Homeland Security (DHS)—the only university holding these designations

- **LSU** has recently announced the creation of the LSU Transformational Technology and Cyber Research Center, which will pursue major federal and commercial research projects in applied technology fields. Initially, the TTCRC will be funded in part by the State of Louisiana and LSU in a challenge grant configuration that provides $1 in state funding and $0.50 in LSU funding for each $10 in research funds the center attracts over the next three years.

- **UL Lafayette** researchers within the School of Computing and Informatics are working with Charles River Analytics of Cambridge, MA to create software that detect harmful malware attacks and prevent damage. The partnership secured US Air Force grant, *Semi-Supervised Algorithms Against Malware Evolution*, to build a cloud-based system that recognizes and automatically responds to changing malware threats. This research is used by the Air Force and other commercial entities to fend off hacking attempts on a growing range of technologies, including personal communications devices. In the area of "Internet of Things", researchers at the Center for Advanced Computer Studies have received NSF funding for a project entitled "Featherlight Information Network with Delay-Endurable RFID Support (FINDERS)."

Recommendations:

- **Short-term:** BOR consider investing funds into hosting a statewide workshop on cybersecurity and IOT including researchers, industry leaders and federal government sponsors. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, Industry leaders, Louisiana Economic Development, Federal Agencies.

- **Medium-term**: BOR consider investing seed funds into teams interested in developing NSF, DHS, NIST, DOD centers and commit 1:1 matching funds as teams submit proposals to be designated as national-scale centers in this area. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, Federal Agencies.

- **Medium-term**: BOR consider leveraging its prior investments into LONI to build a statewide cyber-infrastructure/IOT testbed. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, LONI Management Council.

- **Long-term:** Expand investments into CIC and research universities across the state to develop Louisiana as a National Cyber Security Center of Excellence for Research and Education. *Key Participants*: Cyber Innovation Center, BOR Office of Sponsored Programs, VPs/VCs of Research.

2.A. Tech Transfer and Commercialization

Collaborations exist with Louisiana-based industry partners such as Cyber Innovation Center, IBM, CGI, CSC, GE Capital, in addition to national scale CVDI IAB members, as well as major defense contractors resident within the CIC such as Boeing, Northrop Grumman, among others. These companies are all focused on growing their respective business offerings in the area of cyber-security products and services. Strong partnerships that Louisiana universities have with these companies provide significant opportunities for commercialization of technologies developed at universities in Louisiana.

Recommendations:

- **Short-term:** Fully exploit opportunities for integration of the Cyber Innovation Center into research and technology transfer opportunities in the area of cyber-security and IOT as an asset for all Louisiana universities. Establish MOUs between universities and the CIC for usage of the Sensitive Compartmented Information Facilities (SCIFs) located at the CIC. *Key Participants*: Cyber Innovation Center, BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, Industry.

- **Medium-term:** Fund translational research opportunities in the area of cyber-security and IOT. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, Industry.

- **Long-term:** Establish a statewide proof-of-concept funding that is vital to transferring the research out of the labs and into the marketplace. *Key Participants*: Louisiana Economic Development, Louisiana Innovation Council, BOR Office of Sponsored Programs, VPs/VCs of Research, Louisiana Venture/Angel fund operators such as Louisiana Fund One/Two, etc.

3.A. Workforce Development

- *Louisiana Tech: B.S. in Cyber Engineering*: Louisiana Tech became the first university in the US to offer a Four Year B.S. degree in Cyber Engineering when the Board of Regents reviewed and approved the proposal in 2011. The curriculum was developed in close collaboration with the US Air Force Research Laboratory to meet an urgent and growing national need. Students

began enrolling in Fall 2012 and the program will have the first graduate in Spring 2015. Louisiana Tech also offers a graduate certificate program in Communication Systems exclusively taught at CenturyLink headquarters in Monroe, LA. The university also offers a graduate certificate program in Information Assurance and an undergraduate certificate of completion in Information Technology to support the workforce development needs of the region and beyond.

- *UNO:* For the past two years, Professor Golden G. Richard III of GNOCIA and the UNO Computer Science Department has collaborated with representatives of the Communities in Schools: *ScienceREACH* program to introduce students at local high schools in the New Orleans area to topics in Information Assurance, concentrating on digital forensics. Prof. Richard visits each school, delivers a one hour presentation to a selected group of students, and introduces digital forensics as a scientific field and as a potential career choice. A field trip is then coordinated that allows the students to visit the laboratory facilities in the Greater New Orleans Center for Information Assurance (GNOCIA) at UNO and perform a mock forensic investigation under the tutelage of GNOCIA faculty and graduate students. Most recently, in February 2012, students from G. W. Carver High School visited UNO for a tour of the facilities and to gain experience with real digital forensics tools.

Specific investment opportunities include the following:

- **Short-term**: BOR consider support for the creation of undergraduate and graduate courses and degree programs for traditional students in the area of cyber-security and IOT. BOR should specifically support linkages between research universities, community and technical colleges, and K-12 schools for workforce development in this critical area. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Louisiana Workforce Commission, Louisiana Economic Development, Louisiana Department of Education, Louisiana Community and Technical College System (LCTCS).

- **Medium-term:** BOR should consider supporting the development of flexible-duration certification programs for industry professionals and non-traditional students. These courses should be available both in traditional and on-line distance learning delivery models. Further, BOR should dedicate matching funds (1:1 match) to support industry apprenticeship and internship opportunities. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Louisiana Economic Development FastStart.

- **Long-term:** Expand investments into CIC and research universities across the state to develop Louisiana as a National Cyber Security Center of Excellence for Research and Education. *Key Participants*: Cyber Innovation Center, BOR Office of Sponsored Programs, VPs/VCs of Research.

AREA #2: ALIGNMENT WITH EVALUATION CRITERIA

1. *Maintain and build strength in targeted foundational science and technology disciplines identified in FIRST Louisiana:* These research topics support the FIRST LA framework beginning with foundational sciences in Computer Science, using "Bits and Bytes" to enable core research in Computational Science and IT, which contributes ultimately to industries which employ IT, Digital Media and Cyber Security to produce Digital Media and Software. Given the unique, cross-cutting nature of Cyber Security and IOT, we expect this research area to result in innovations in multiple Core Industry S&T sectors as well as High Growth Target Industries identified by LED. This research is expected to impact industries ranging from materials and chemical manufacturing, energy production, biomedical and healthcare innovations, to the applications in digital media, cyber- and cyber-physical systems.
2. *Promote targeted multidisciplinary and multi-institutional collaborative research efforts:* Cyber-security research is inherently multi-disciplinary, sitting at the intersection Computer Science, Social Sciences (law, policy) and Mathematics (algorithms, analytics) as foundational scientific building blocks. As noted previously, research universities in Louisiana have each invested substantially in this area – in research, economic development and workforce development; have collaborated extensively in this area; and are well positioned to leverage prior statewide collaborations to enhance Louisiana's national standing in this high-priority area.
    - **DHS Critical Infrastructure Resiliency Center (CIRC)** - The recent submission of a proposal to DHS including ALL of Louisiana's research universities, CIC, industry and other national universities is an excellent example of multi-disciplinary, multi-university collaboration in the cyber security arena. If funded, this DHS COE will expand Louisiana's credentials in the domains of cybersecurity and homeland security.
    - **Cyber Innovation Center (CIC)** - collaborative sponsored research projects, sponsored technology transfer projects, Cyber Discovery Camps and other outreach programs *(collaboration between LaTech, CIC, University of Baltimore and area high schools)*
    - **Industry Consortium for Innovations in Communications, Information and Cyberspace ({IC}3)** – Collaborations with telecommunication corporations, information technology companies, and industry leaders *(collaboration between LaTech, and companies including CenturyLink, Amdocs, CIC and Fenway group)*
    - **Center for Secure Cyberspace** - Education and research in integrated smart cyber-centric sensor surveillance systems. *(collaboration with LSU)*
3. *Demonstrates prospective alignment and competitiveness with national priorities, needs, and funding:* As previously noted, Cyber Security/IOT is a big national priority. During the past two years, the federal government provided over $23B in grant funds in the area of cybersecurity. For the year

2015, just within one agency, (the DHS), cybersecurity funding represents about 3 percent, or $1.3 billion of the president's $38.2 billion funding proposal for DHS. That's a boost from the $792 million in cybersecurity funding Congress approved for DHS this fiscal year.The White House has designated Cyber Security as a strategic national imperative.

4. *Sustain and advance targeted research commercialization and translational activities that promote economic development in Louisiana:* The presence of the Cyber Innovation Center and mature cybersecurity programs at multiple research universities serves as a great foundational platform upon which Louisiana can accelerate translational research activities. With the advent of high-technology companies such as IBM, GE Capital, CGI, CSC, etc., there are great opportunities to advance targeted research commercialization efforts.

AREA 3: ENTERPRISE COMPUTING AND SOFTWARE DEVELOPMENT

1.A. Research Initiatives

According to MarketLine analysis, the world enterprise computing and software development market exceeded $265 billion in 2010. Market growth is expected to exceed 6% yearly between 2010 and 2015, bringing the market to almost $357 billion. Enterprise computing, business applications, personal computing and mobile applications, cloud services, network and database management, operating systems and other systems software, are among the fastest growing segments within the enterprise marketplace.

At the federal level, the Directorate for Computer and Information Science and Engineering (CISE) of the National Science Foundation funds research and development efforts in the area of enterprise computing. The President's 2014 budget has allocated $950,250,000 USD for research in this area, an increase of approximately $85M over the FY 2012 level. Further, the Networking and Information Technology Research and Development (NITRD) Program provides a framework in which many Federal agencies come together to coordinate their computing, networking and information technology (IT) research and development (R&D) efforts. Areas of investment include: Big Data Research and Development (BD); Cyber Physical Systems Research and Development (CPS); Cybersecurity and Information Assurance Research and Development (CSIA R&D); Health Information Technology Research and Development (HITRD); and Wireless Spectrum Research and Development (WSRD). The President's FY 2015 budget request for the NITRD Program is $3.8 billion and the 2014 NITRD budget estimates totaled $3.9 billion.

At the state level, with innovative incentives and Oscar-worthy talent, Louisiana was the top-ranked state for Digital Media in Business Facilities' 2012 State Rankings Report. Louisiana's digital media incentive is the strongest in the United States. Other states offer similar incentives, but they do not cover the range of development activities that Louisiana incentivizes. Louisiana offers tax credits for video game development, consumer software, enterprise software, web-based software, mobile applications, interactive devices and embedded systems. The program is also unique in that it offers incentives to both small and large companies with no minimum or maximum spend threshold as required in most other states. The Digital Interactive Media tax credit program was enacted in 2005 by the Louisiana legislature and was originally designed to attract companies and increase development in the video game sector in Louisiana. In 2009, the focus of the program was expanded to also include a broad spectrum of digital media and software applications in addition to video games including: Mobile Apps and Internet Platforms (SAAS); Enterprise Software; E-commerce platforms; Mobile communication including cell phones and GPS navigation; Online learning and training; and Interactive devices. Most companies receiving these digital media tax benefits have been encouraged to establish strong partnerships with research universities and education partners within their regional ecosystem. As such, Louisiana research universities and their private sector partners are well positioned to attract these funds, as evidenced below.

1.B. Existing and Prospective Strengths

- LSU's Center for Computation and Technology (CCT) is the focal point for research in the Core Computing/High Performance Computing cluster and interacts with all other clusters. CCT, in collaboration with the Coastal Sustainability & Environment focal area, has established a hiring plan to recruit four computational modelers to LSU with the goal of both strengthening our computational modeling expertise and reviving our strength in preparing for and analyzing disaster related phenomena, especially with respect to hurricanes and modeling coastal land-loss and restoration processes.
    - LSU's College of Engineering has partnered with Louisiana Economic Development to rapidly grow the state's technology workforce and support the new IBM Services Center in Baton Rouge. A total of 800 IT jobs will be created at the center over the next four years.
- UL Lafayette's School of Computing and Informatics (including the globally-recognized Center for Advanced Computer Studies) as well as the Informatics Research Institute (IRI) comprising the Center for Business and Information Technologies (CBIT) and NSF CVDI are the foci for academics, research, workforce development and economic development efforts of the university in the area of computing and informatics.
    - CACS – the nation's oldest graduate program in Computer Science - is the only computing program in Louisiana with 4 NSF CAREER awardees on its faculty; CBIT is recognized by the White House as a "Living Lab for Health Innovations", and NSF CVDI as the nation's only NSF industry-university Center of Excellence in Big Data.
    - UL Lafayette has partnered with LED and Lafayette Economic Development Authority to recruit three IT companies in 2014 which cumulatively are expected to create 1000 direct IT jobs in the Acadiana region. These include: CGI Federal, a Top 5 IT services company in the world (400 jobs), Enquero, a Silicon Valley-based agile services startup company (350 jobs), and Perficient, an IT services company (245 jobs).
    - In a direct response to the needs of these three IT companies, CBIT is developing a partnership with the South Louisiana Community College resulting in the *Center for Software Excellence*. The CSE will be located within the $13M, 50,000 ft^2 building being built within the University Research Park to serve as the new home for CGI.
- Louisiana Tech's strength in computing, cyber security, entrepreneurship, commitment to economic development and collaborations with CIC resulted in:
    - The recruitment of CSC to Louisiana, creating 800 IT jobs in the region.
    - Establishment of the Louisiana Cyber and Data Consortium (LACDC). LACDC membership includes companies such as Computer Sciences Corporation (CSC), CenturyLink, IBM, GE Capital, and Dell.
    - Louisiana Tech also serves as the academic partner for CenturyLink, one of the only two fortune-500 companies in the State of Louisiana and headquartered in Monroe, LA, by offering multiple programs to suit the needs of CenturyLink employees, and eventually contributes to the retention of the company in the region.

- UNO's strength in computing, cyber security, and commitment to economic development resulted in a unique partnership with GE Capital.

Recommendations:

- **Short-term:** BOR team up with LED and major IT companies in Louisiana (IBM, CGI, CSC, GE Capital, Perficient, GameLoft, EA Sports, etc.) and consider investing funds into hosting a statewide workshop on enterprise computing and software development including researchers, industry leaders and federal government sponsors. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, Industry leaders, Louisiana Economic Development, Federal Agencies.

- **Medium-term**: BOR consider investing funds into Computing Centers of Excellence at research universities throughout Louisiana that leverage its prior investments into LONI and the LONI Institute. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, LONI Management Council.

- **Long-term**: BOR consider working with the State Legislature and the Governor to reinstate funding for the Governor's Information Technology Initiative (GITI) that was created under Governor Blanco. To a significant extent, the GITI sowed the seeds for Digital Media and Computing revolution currently underway in Louisiana. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, State Legislature, Office of the Governor.

2.A. Tech Transfer and Commercialization

- Louisiana Tech University pursues applied interdisciplinary research activity that links STEM fields with entrepreneurship and technology commercialization to drive new innovations to market in collaboration with the private sector. This work is conducted through the efforts of Integrated STEM Education Research Center (College of Engineering and Science); Center for Entrepreneurship and Information Technology (College of Business, and College of Engineering and Science); and Proof of Concept Center (Enterprise Campus)

    - Louisiana Tech is considered Top 15 in the nation among U.S. institutions for number of U.S. patents issued per research dollar and number of start-up companies formed per research dollar, according to AUTM. Top 10 in the nation among U.S. institutions for Reports of Invention (ROI) per research dollar, according to AUTM. Top ten in the nation for technology commercialization (2007 and 2008)

- In addition to overhauling its IP and revenue sharing policy, UL Lafayette has recently established the *AcceleRagin* – a faculty/student business accelerator to enhance economic development opportunities through the creation of research-driven spin off and startup companies. The B.I. Moody III College of Business and the Office of Innovation Management oversee the

implementation of this program, with support from the Louisiana Small Business Development Center.

- LSU recently launched a new proof-of-concept funding program, the LSU LIFT, or Leveraging Innovation for Technology Transfer, Fund. The LSU LIFT Fund will provide support for commercialization of faculty intellectual property – support difficult to come by through traditional means. Providing a bridge over the critical gap between basic research and commercialization, the LSU LIFT fund would – if approved by the Board of Supervisors – provide grants to faculty on a competitive basis twice a year, in amounts up to $50,000, to validate the market potential of their inventions.

Recommendations:

- **Short-term:** Fund translational research opportunities in the area of enterprise computing; especially with enhanced funding allocation to the BOR ITRS program. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Faculty, Industry.

- **Medium-term:** Establish a statewide proof-of-concept funding (and centers such as the Proof of Concept Center at Louisiana Tech) and that is vital to transferring the research out of the labs and into the marketplace. *Key Participants*: Louisiana Economic Development, Louisiana Innovation Council, BOR Office of Sponsored Programs, VPs/VCs of Research, Louisiana Venture/Angel fund operators such as Louisiana Fund One/Two, etc.

- **Long-term:** Louisiana should leverage its status as an EPSCoR State and pursue opportunities with the National Science Foundation, and other agencies to pursue the development of a ***Translational Technologies Center*** to work with federal contractors and the Federal Government in the development of proof-of-concept systems. It should be the goal of this effort to result in the development of a FFRDC in Louisiana. *Key Participants*: BOR Office of Sponsored Programs, Louisiana's Congressional Delegation, Office of the Governor, Presidents/Chancellor of Louisiana's academic institutions, Federal Agencies.

3.A. Workforce Development

- Louisiana Tech University has entered into a partnership with global IT leader Computer Sciences Corporation (CSC), Louisiana Economic Development (LED) FastStart, and the Cyber Innovation Center in Bossier City to offer current and prospective students a comprehensive suite of cyber-related programs and career opportunities designed to meet the current and future needs of CSC.
    - Fenway Xperience: Integrated business, workforce, & technology development partnership based in Louisiana Tech's Enterprise Campus. Providing IT and software development services to major corporate clients while training the next generation of IT professionals.

- GE Capital – UNO partnership with LED FastStart leading to the Software Engineering Apprenticeship Program (SWEAP) which is widely regarded as a model public-private partnership. In addition to providing apprentices with industry mentorship from GE Capital technology professionals and real-world experience, the partnership with UNO will include GE Capital's investment in UNO's computer science curriculum to ensure that this pipeline of talent remains vibrant into the future.

- UL Lafayette Center for Software Excellence will partner with the newly established University College and South Louisiana Community College's Application Software Development Program to provide internships and coops that will provide high-school, undergraduate and graduate students with hands-on opportunities to work on real-world projects with industry. The CSE will be physically located within the 50,000 ft^2 CGI building under construction within the University Research Park.

- LSU partnership with IBM and EA Sports through the College of Engineering leading to the development of curriculum to meet the needs of industry.

Specific investment opportunities include the following:

- **Short-term**: BOR consider support for the creation of undergraduate and graduate courses and degree programs for traditional students in the area of enterprise computing and software development, with focus of agile software development and cloud computing. BOR should specifically support linkages between research universities, community and technical colleges, and K-12 schools for workforce development in this critical area. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Louisiana Workforce Commission, Louisiana Economic Development, Louisiana Department of Education, Louisiana Community and Technical College System (LCTCS).

- **Medium-term:** BOR should consider supporting the development of flexible-duration certification programs for industry professionals and non-traditional students. These courses should be available both in traditional and on-line distance learning delivery models. Further, BOR should dedicate matching funds (1:1 match) to support industry apprenticeship and internship opportunities. *Key Participants*: BOR Office of Sponsored Programs, VPs/VCs of Research, Louisiana Economic Development FastStart.

- **Long-term:** Consider development of statewide partnerships with software companies (like IBM, Dell, Oracle. SAP, etc.) and acquire statewide technology licenses for tools for research, instruction and training. *Key Participants*: BOR Office of Sponsored Programs, Division of Administration Office of Information Technology, VPs/VCs of Research.

AREA #3: ALIGNMENT WITH EVALUATION CRITERIA

1. *Maintain and build strength in targeted foundational science and technology disciplines identified in FIRST Louisiana:* The research area of enterprise computing fits within the foundational sciences area of "Computer Sciences"; producing innovations and 21st Century Building Blocks that are manifest in "Bits and Bytes". Core Enabling S&T Research advances in Computational Science and Information Technology will result in translational research in Digital domains. Given the cross-cutting nature of computing, we expect this research area to result in innovations in multiple Core Industry S&T sectors as well as High Growth Target Industries identified by LED. Computing research is expected to impact industries ranging from materials and chemical manufacturing, energy production, to coastal and water management, biomedical and healthcare innovations, to the applications in digital media, cyber- and cyber-physical systems.

2. *Promote targeted multidisciplinary and multi-institutional collaborative research efforts:* Enterprise Computing research is inherently multi-disciplinary, sitting at the intersection of Computer Science, Social Sciences (law, business, policy) and Mathematics (algorithms, analytics) as foundational scientific building blocks. As noted previously, research universities in Louisiana have each invested substantially in this area – in research, economic development and workforce development – and are well positioned to leverage prior statewide collaborations on such initiatives as LONI to enhance Louisiana's national standing in this high-priority area.

3. *Demonstrates prospective alignment and competitiveness with national priorities, needs, and funding:* As previously noted, Computing is a big national priority, with over $3.8B in federal funding. The White House has designated Computing as a national imperative.

4. *Sustain and advance targeted research commercialization and translational activities that promote economic development in Louisiana:* With the advent of high-technology companies such as IBM, GE Capital, CGI, CSC, etc., there are great opportunities to advance targeted research commercialization efforts.